

# GEODYN Documentation NEWS

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## 0.1 GEODYN VERSIONS

### 0.1.1 2002

#### NEW GEODYN VERSION 2002

#### GEODYN VERSION 2002 FEATURING...

1. Introducing the SRIF (Square Root Information Filter) option.  
SRIF is a reliable and effective method for computing numerically accurate estimates in problems where high precision is required. Square root formulations increase numerical computation accuracy by guaranteeing positive-definiteness of the associated covariances and by decreasing the condition numbers of the normal matrices.  
  
The SRIF option is invoked by using the index 1 on column 10 of the INVERT option card. (global)
2. Introducing the Reduced Normal Matrix option.  
GEODYN considers the adjusted parameters as a group of parameters where all adjust with their assigned sigma value. Some parameters are often tightly constrained and do not change with the adjustments. This scenario may produce very large normal matrices. With this option any GEODYN parameter for which the sigma is less than a certain constant, will not be contributing in the normal matrix. The Reduced Normal Matrix option is activated with the use of a sigma value on columns 72-80 of the EMATRIX option card. (arc)
3. Introducing the R.Robertson's Penumbra model for one or more satellites. A new option card (PENUMB) has been created to introduce this model.
4. Several code corrections pertaining to altimetry and crossover measurement types.

## 0.1.2 1906

NEW GEODYN VERSION 1906

GEODYN VERSION 1906 FEATURING...

HUBER WEIGHTING FOR OBSERVATIONS

1. I begin with a note from Dave Rowlands who introduced this capability to GEODYN:

"Terry Sabaka (Code 61A) suggested we add a Huber weighting capability. Remember, GEODYN least squares solutions try to minimize the sum of  $(\text{resid}_i/\text{sig}_i)^2$  for all of the observations. The  $\text{sig}_i$  quantity is the assigned standard deviation of the observation. The weight applied to the observation in the summing (or SRIFing) of the normal equations is  $1/\text{sig}_i^2$

Some observation types like altimetry tend to have some mis-modeled observations that have larger residuals. Least squares pays special attention to these and that can be unfortunate.

With Huber weighing a user can specify a number, C (1.5 is a typical specification for C). If the ratio of  $\text{DABS}(\text{resid}_i)/\text{sig}_i$  is larger than C, then the original weight that would have been applied to that observation is multiplied by  $C \cdot \text{sig}_i / \text{DABS}(\text{resid}_i)$  to obtain the new weight that is actually applied. The result of this is to cause what the solution is minimizing to change. The solution now minimizes the combination of the sum of  $(\text{resid}_i/\text{sig}_i)^2$  for all small residuals plus the sum of  $\text{DABS}(\text{resid}_i)/(C \cdot \text{sig}_i)$  for all large residuals. This accommodates the larger residuals without bending the solution so much towards them. The norm is L2 for small residuals and L1 for large residuals.

To get Huber weighting, put a HUBER card in the arc portion of your input deck. Specify the C value in cols 25-44. If you leave cols 15-17 blank, the weighting will be applied to all measurement types. If you specify a measurement type number in cols 15-17, Huber weighting will be applied to that measurement type only. You can have multiple HUBER cards with different C values for different measurement types.

If you do not alter your input deck, your data will continue to be weighted in your solutions the same way it has always been.

2. To see the description of the new ARC SECTION CARD HUBER please visit:  
<https://neptune.gsfc.nasa.gov/uploads/files/volume3.pdf>  
And click on the HUBER link in the arc section. (Right after HRATEF)

### 0.1.3 1810

NEW GEODYN VERSION 1810

GEODYN VERSION 1810 FEATURING...

There are two new options in version 1810

A. New GLOBAL option ANTENNA TRANSPONDER DELAY

A new GLOBAL card ADELAY describes the option.

B. New ARC option FINITE BURN MODEL described by the following group of cards:

FNBURN

THRUST

FLRATE

THRRTA

THRDEC

ENDBRN

FNBEND

C. Furthermore, in version 1810, we have a careful code cleanup from Dave Rowlands in some convoluted areas of the code. The first is a force model pointer cleanup (more relevant to the the programer than the user). The second is the ATITUD modeling code which was also very confusing and in some cases it could cause problems. The user here must be aware that he/she must include ATITUD cards for the lasers or the camera besides the S/C ATITUD cards, whenever altimetry or camera data are present.

#### 0.1.4 1802

NEW GEODYN VERSION 1802

GEODYN VERSION 1802 FEATURING...

A. OLOAD/ETIDE/OTIDE code enhancements and new setups: Some coding problems in GEODYN associated with the ETIDE, OTIDE and OLOAD options have been found and fixed. There were problems with which tides would receive side band computations. Now all OLOAD inputs will automatically receive side band computations. There is no longer any assumption about ETIDES and OTIDES that share the same Doodson number also sharing the same side band option. Also information about angular offsets of multiples of  $\pi/2$  in the ETIDES and OTIDES has been cleaned up. Due to all these cleanups, the results you will get using 1802 may differ from the results of previous versions, especially when tidal computations are important. The 1802 work is the result of a big effort by Richard Ray and Dave Rowlands. In the following suggested setups, the consideration was, making the input consistent with widely accepted conventions. As a result the OLOAD cards input into GEODYN in future versions will be subject to a much larger default list of angular increments.

Richard Ray also put together setups for the OLOAD CARDS USED FOR EOP  
(Earth Orientation Parameters)

for the OLOAD CARDS USED FOR COM (Center of Mass variations)

for the ETIDE cards

and for the OTIDE cards

Part of his consideration was making the input consistent with widely accepted conventions. As a result OLOAD cards input into GEODYN in future versions will be subject to a much larger default list of angular increments. Please look at the updated a OLOAD option.

B. The POLDYN option has been updated with clear explanations on using the option. Furthermore version 1802 features the availability of two new models of the secular pole path. Check models 4 and 5 on col. 14. The use of GEOPOL is required for these two models

C. Finally the POLTID option requires the definition of a model for the Mean path of Polar Motion. This model MUST be specified on the POLDYN option card. Unfortunately, versions prior to 1802 GEODYN will proceed to compute an invalid POLTID correction without a POLDYN card. GEODYN 1802 will terminate with an error message if you try to use a POLTID card without a POLDYN card. Check the updated POLTID option card.

## 0.1.5 1612

NEW GEODYN VERSION 1612

GEODYN VERSION 1612 FEATURING...

Introducing the following new/updated options in GEODYN:

1. Introducing the PPN relativity model. The third-body perturbation of each body (Sun, planets and asteroids) is derived from the isotropic, parametrized post-Newtonian (PPN) n-body metric. The acceleration of the spacecraft and the integrated body due to interaction with other point masses follows the formulation reported in Eq. 27 of : " The Planetary and Lunar Ephemerides DE430 and DE431 " by Folkner et al. 2014. There are two parameters associated with this model, Gamma and Beta defined on the new RELPPN global option.  
This model was originally implemented to apply on asteroid runs but in this version it maybe used for any GEODYN run. The presence of a REL300 in the same deck, sets RELPPN the preferred relativity model.
2. Introducing two new parameters. J2 of the SUN and GM of the SUN. The new global options GMSUN and J2SUN allow the definition and solution of the two parameters.
3. Introducing the new global option MLTDEM which sets the infrastructure for using more than one GRID files (Digital Elevetaion Models) to be read in GEODYN IIE. The presence of other GRID will be ignored un thepresence of MLTDEM. There is no limit to the number of DEMs read in IIE and a bilinear interpolation is performed, using latitude and longitude with a variety of different projections.
4. In version 1612 we are increasing the number of perturbing celestial bodies. Up to now only 9 extra bodies were allowed in the supplementary ephemeris. Now the number is 988. This plus the known 21 bodies defined on the PLANET option card, make 999 total bodies. There have been some changes in the EPHEM2 and the SCBODY global options to accommodate this feature. Starting with 1612 please check your EPHEM2 and SCBODY cards for changes. Furthermore GEODYN was modified to accept a fraction of the day as length of validity for the featured Chebyshev coefficients.
5. There is a new option on the PANEL arc option to allow SFLUX contribution from either just short-wavelength (albedo) flux, or just long-wavelength (thermal) flux, or both (as currently)

## 0.1.6 1610

NEW GEODYN VERSION 1610

GEODYN VERSION 1610 FEATURING...

Introducing the following new/updated options in GEODYN:

1. GEODYN 1610 introduces the capability of processing observations from BINARY ASTEROIDS. New parameters are being introduced to describe and improve the second asteroid characteristics (orientation, gravity field and shape) The BINARY ASTEROID case dictates that the INTGCB global option is present. Also the presence of the new GLOBAL option BINAST is mandatory. A BINARY ASTEROID data processing run requires the presence of at least two sets of elements. (SATPAR/EPOCH/ELEMS1/ELEMS2). The first set is the primary asteroid (central body). The second set and any other sets that follow are the second asteroid and all other possible artificial satellites. The orientation definition of the binary asteroids introduces modifications of the PLANOR GLOBAL option which up to now could handle only one planetary body. Furthermore GEODYN requires the presence of MOMENTS OF INERTIA for both asteroids even when the ANALYTICAL model of Planetary Orientation is used (up to now only the DYNAMIC Planetary Orientation was using as input Moments of Inertia)

The Gravity field of the second body is input to GEODYN IIS via the setup (unit 5) using the new GLOBAL options G2COFC (C coefficients) and G2COFS (S coefficients). There a limit of 39 G2COFC and 39 G2COFS cards in a secondary gravity field (describing a degree and order 6 field)

In addition to the gravity coefficients which are new parameters in GEODYN, there are two more parameters: The semi-major axis and the GM of the secondary body found on the BINAST GLOBAL option card.

2. The COMCOF (Center of Mass- Center of Figure) capability is now available for METRIC type data (besides ALTIMETRY)
3. An important VMF (Venna Mapping Function) correction for data in the year 2000
4. An important orientation correction to heliocentric cases using PANEL option cards
5. Correct (most recent) IDS GPS definitions.

## 0.1.7 1507

NEW GEODYN VERSION 1507

GEODYN VERSION 1507 FEATURING...

Introducing the following new/updated options in GEODYN:

1. The application of an LRA correction for the SARAL S/C is now a user option. The LRARC card has been updated to reflect this addition.
2. UCL models related satellite arrays have been changed to accept up to 50 satellites.
3. Version 1507 contains many updates and fixes to GPS related problems. A problem with external ephemeris in GPS runs was corrected. The problem showed up if one of the GPS satellites did not have data. Subroutine SATECLIPSE (based on Ian Kouba's yaw computing model for GPS satellites, has been corrected from various bugs provided by Oscar Colombo. An error in the computation in the GPS time subroutine was corrected. Finally in the GPS attitude code, a bug in computing the True of Date satellite body fixed unit vector when the yaw was re-computed in SATECLIPSE was fixed as well.

## 0.1.8 1501

NEW GEODYN VERSION 1501

GEODYN VERSION 1501 FEATURING...

Introducing the following new/updated options in GEODYN:

1. Updates have been made to the PLANOR option.

Starting with version 1501 many upgrades have been made to the PLANOR capability. There are now two types of models available, analytical and dynamic.

In GEODYN versions prior to 1501, the PLANOR option is used to create a user defined analytical model for the planetary orientation parameters. The analytical model uses linear terms for the RA and DEC and a quadratic model with an arbitrary number of periodic terms for the W angle.

In analytical mode the RA and DEC now have periodic terms in addition to the linear terms.

The dynamic orientation model is used when there is a "1" in column 7 of the INTGCB option. So, the dynamic orientation model is available only when the orbit of the central body is being numerically integrated. In dynamic mode there are 12 parameters and the orientation of the axes is numerically integrated from the initial state at the initial arc epoch.

See the PLANOR option for detailed information.

For a theoretical description of the dynamic model, see volume 1 of the documentation, Section 8.16 - Orientation Initial Conditions - Variational Equations

2. 1501 has been updated to process Altimetry Constraints (distances on the planet's surface and radial separation) using Regular Integration mode. Up to now, the processing of these data was possible only by using Rapid Integration mode.

### 0.1.9 1410

NEW GEODYN VERSION 1410

GEODYN VERSION 1410 FEATURING...

Introducing the following new/updated options in GEODYN:

1.

#### PLANOR

This option has been modified and expanded.

- a. The old PLANOR scheme with rotation periodic terms has been expanded. Now we also include periodic terms for right ascension and declination. The user must be careful as the indices on the option cards have changed as well.

On the PLANOR card we explain the new notation.

We give here a brief explanation of how the indices have changed:

	OLD INDICES	NEW INDICES	PARAMETER
	col 7-8	col 7-8	
PLANOR	1	1	Right Ascension
PLANOR	2	2	Right Ascension rate
PLANOR	3	3	Declination
PLANOR	4	4	Declination rate
PLANOR	5	5	Rotation
PLANOR	6	6	Rotation rate
PLANOR	7	7	Rotation acceleration
PLANOR		11	Right ascension coef to coswt term
PLANOR		12	Right ascension coef to sinwt term
PLANOR		21	Declination coef to coswt term
PLANOR		22	Declination coef to sinwt term
PLANOR	8	31	Rotation coef to coswt term
PLANOR	9	32	Rotation coef to sinwt term

- b. The PLANOR option may be used to solve for the first 7 angles as above plus six more that represent moments of inertia. In a case like this no periodic terms are allowed in the setup. An example is provided below:

PLANOR	1	1	Right Ascension
PLANOR	2	2	Right Ascension rate
PLANOR	3	3	Declination
PLANOR	4	4	Declination rate
PLANOR	5	5	Rotation
PLANOR	6	6	Rotation rate
PLANOR	7	7	Rotation acceleration
PLANOR		01	
PLANOR		02	
PLANOR		03	
PLANOR		04	
PLANOR		05	
PLANOR		06	

- c. There are two new features with the PLANOR option. Up to now only one global iteration was permitted in a run with PLANOR options. Now more global iterations are allowed. The user may also re-set the epoch time of the PLANOR elements. Up to

now the default epoch J2000 at 12 noon was accepted.

2. The capability to apply a correction to the Earth center of mass is a new global option in GEODYN. The GCMMOD option requests the application of a periodic Earth center of mass correction model. The model is used to modify the position of tracking stations. Multiple periodic terms may be used.
3. A new global option COMCOF introduces application and/or adjustment of 3 components as a correction for the Center of Mass- Center of Figure offset of an orbited celestial body. This capability is currently available only for altimetry data types.
4. Corrections to problems resolved in the recent past.
5. Technical Note: The GEODYN group has started on an effort to 'modernize' the program. Code has been added as this task progresses, but this will NOT impact the user at this point. Some subroutines are utilizing an INCLUDE file with implicit declarations for all common block variables. A different INCLUDE file is needed for IIS and IIE. These files must be present in the directory where GEODYN is compiled. The INCLUDE files will be present on the GEODYN code directories /data /mods and /next (xyz2:/Users/geodyn/CODE/IIS/1410/data) OR they can be provided on demand with the GEODYN code.

## 0.1.10 1404

NEW GEODYN VERSION 1404

GEODYN VERSION 1404 FEATURING...

Introducing the following new/updated options in GEODYN:

1. A new routine for inverting the normal matrix has been developed by Joseph Nicholas. The routine, DSINV, uses a Cholesky decomposition. When compiling GEODYN, the new code requires linking to the LAPACK library. To link to the LAPACK library, add `-llapack` when you link the object files together when using a mac machine, and use `-lsunperf` when using the TERRA machine. For example:

```
ifort -o giie *.o -llapack (mac)
f95 -o giie *.o -lsunperf (terra)
```

2. A new atmospheric density model has been added for Mars. The DTM-MARS model (Bruinsama and Lemoine) allows for user input for the value of the dust opacity (default = 0, no dust storm), see the ATMDEN option card
3. Elevation dependent weighting has been introduced to GEODYN. If an observation is below a given elevation angle, the weight of the observation will be decreased using a down weight scale factor. This capability is measurement type dependent. The user will select a maximum elevation angle at which elevation dependent weighting will be applied. The user will then supply down weight scale factors at one degree intervals down to zero, see the ELEVWT option card. GEODYN will use a linear interpolation to calculate the appropriate scale factor depending on the calculated elevation angle. This capability is available only for metric type data.
4. New POLDYN option, see POLDYN option card The new option for POLDYN uses the IERS2010 definition for mean pole and solid earth tide, but the values of C21/S21 are user supplied using the GCOEFC/GCOEFS option cards.
5. Some problems fixed recently have been corrected in version 1404. The correction of the Y-axis orientation for satellite HY2A, a larger number of TARGETS allowed for LANDMARK processing (200000), the PLANOR parameter units are in agreement with the partials units (deg and deg/sec) in the EMATRIX file, and correct a problem in EXPLOR that assumed PLANOR parameters to be the last set of global parameters.

### 0.1.11 1312

NEW GEODYN VERSION 1312

GEODYN VERSION 1312 FEATURING...

Introducing the following new/updated options in GEODYN:

1. New capability for processing LANDMARK data in GEODYN. The LANDMARK measurement consists of one set of (X,Y) pixel coordinates. The location of the Landmark that is being observed is input into GEODYN using the TARGET option. The new measurement type is GEODYN MTYPE=34. See Data Structure for LANDMARK Data for how to set up the G2B data file.
2. Additional parameters have been added to the CAMERA option. The camera option consists of adjustable (distortion and focal length) and unadjustable (center of CCD and K-matrix) parameters associated with the IMAGE data type (MTYPE=33) and LANDMARK data type (MTYPE=34). Once CAMERA options are included in the setup, ALL 5 adjustable parameters, per camera, will be solved for using a default sigma value (0.100E-19). The user may adjust the sigma value with the CAMERA card.
3. A Multicamera capability has been introduced to GEODYN that requires a camera ID for each camera. The CAMERA option now requires a camera ID instead of a satellite ID. The satellite ID is still part of the G2B data and in the measurement modeling code GEODYN still knows which satellite is being integrated. The CAMERA ID is featured on the Data Location Records of the G2B file, see Data Structure for Optical Data.
4. The planetary orbiter capability, see INTGCB option, has been expanded to allow for more than one artificial satellite.
5. Corrections made for the TUM solar radiation model for GPS satellites. The presence of one or more GPSBXW cards will trigger adjustment for the entire group of parameters for this satellite. If there are no a-priori values on the GPSBXW cards GEODYN IIS will compute a-priori values for each parameter based on the BLOCK of the satellite and it's mass. These parameters cannot be zero as they will produce zero accelerations. Unless the user specifies a sigma on the appropriate GPSBXW card, the parameter will adjust with a sigma=1.D-30.

## 0.1.12 1307

NEW GEODYN VERSION 1307

GEODYN VERSION 1307 FEATURING...

Introducing the following new/updated options in GEODYN:

1. Modified the code for Image data to now process pixels instead of orientation vectors. The input data on the G2B file now contains 2 pixels for each image, instead of x, y, and z unit vectors, see Data Structure for Optical Data. This currently only works for normal (not rapid) integration.
2. New CAMERA parameters associated with the Image data type (MTYPE=33), see CAMERA option card.
3. DORIS Antenna phase map correction capability, using the ANTPHC option card and a corrections table linked to unit 22.
4. A new Albedo and Solar Radiation Model has been introduced for GPS data processing.. The TUM (Technical University of Munich) model can be selected using the TUMSOL and ALBEDO option cards.
5. Ability of solving for a new set of force model parameters associated with the GPS satellite Box-wing TUM model, see GPSBXW option card.

### 0.1.13 1212

NEW GEODYN VERSION 1212

GEODYN VERSION 1212 FEATURING...

Introducing the following new/updated options in GEODYN:

1. The GEODYN REFRAC option has been updated. Each model is coded in a separate subroutine rather than one convoluted one and GEODYN allows comprehensive output to be printed on output unit 400 (fort.400) upon request. The REFRAC option has been modified to allow the user to request for this output information.
2. Geodyn 1212 contains all the code developed earlier by John McCarthy and the ICEATT team and which made the "special ICEATT" version. Part of this code is:
  - a. An updated ICEATT attitude model. Look for changes on the SATPAR option card.
  - b. Updates to the CG (center of gravity) correction and the capability of solving for CG offsets using the FANTOM capability. This option uses FANTOM and FANTIM cards to model the center of gravity offset in the x, y and z components in the satellite body-fixed frame.
  - c. Several code corrections for compiler errors.
3. A new option to allow reading and using an external "Sunlight Ratio Data" input file on unit 77 (fort.77). The input data will be linearly interpolated and used instead of computing them geometrically in the Solar Radiation code. Look for the updated SOLRAD option card.
4. New attitude model for the satellite HY2A. Look for index on the SATPAR option card.
5. Some important code changes to the Altimetry Constraints,
6. Code to compute partials to EOP (nutations in longitude and nutation in obliquity) when using VLBI data. (Up to now the capability of solving for nutations was only for metric type data).
7. Introducing Asteroid data processing in GEODYN. Data from asteroid orbiters will be processed in GEODYN. The new global option INTGCB will introduce an integration mode where the position of the orbiter is integrated around the asteroid and the asteroid position is integrated around the Sun.
8. Introducing DeltaDOR data processing in GEODYN. The DeltaDOR measurement is the difference of the time delay between a S/C and two Earth stations and the time delay of a quasar and the same stations. The new Measurement type is GEODYN MTYPE=36 (a combination of MTYPE 61 singly differenced one way ranges and MTYPE 31 VLBI) The GEODYN II binary data structure may be found in the updated DATA STRUCTURE file.

## 0.1.14 1207

NEW GEODYN VERSION 1207

GEODYN VERSION 1207 FEATURING...

Introducing the following new/updated options in GEODYN:

1. Nutation Correction parameterization. GEODYN will use the old NUTATE option card with new input to specify DPSI (nutation in longitude corrections) and EPST (nutation in true obliquity corrections) information. The NUTATE option works in a manner similar to POLEUT specifying corrections to the above quantities at the middle of a given interval. New EMATRIX label descriptions are given in: Ematrix labels

2. The complete VMF-1 (Vienna Mapping Function) model including adjusting for the difference between the VMF grid height and the station height. The grid heights are interpolated off a file called the orography file. This file is now an input to IIE for the VMF refraction model. It may be found on the GEODYN hub machine xyz2.gsfc.nasa.gov  
(/Users/geodyn/SUPPORT/VMF\_GRID\_FILES/orography\_ell.txt)

There is also a new print option that will allow the user to print EBIAS information to unit 400 for the Tropospheric refraction scale bias. The option only works with EBIAS option cards. Please see REFRAC column 13 for more details.

3. The user can now turn on or off the interpolation code for the C21 and S21 coefficients for Atmospheric Gravity. This used to be a special version referred to as ATGNOINT. Please see the ATGRAV card column 13 for more details.

4. VLBI Antennae Thermal Deformation: Please see Station Coordinate Cards columns 11-12 for more details.

5. Images Rapid Integration. For this option the data structure is different compared to processing Image data using normal type integration. The differences are explained in: DATA STRUCTURE, and the auxiliary file needed for data scheduling is described in Optical Data Auxillary File

6. In version 1207 we are getting back to compute the observing station True Pole Coordinates one at a time and not by block interpolation.

## 0.1.15 1203

NEW GEODYN VERSION 1203

GEODYN VERSION 1203 FEATURING

Introducing the following new/updated options in GEODYN:

1. The user can now select number 8 on column 8 of the REFRAC card to invoke the VMF\_1 (Vienna Mapping Function) empirical function. This function is used to compute the wet and dry components of tropospheric refraction. The computation of the VMF\_1 function requires the use of external VMF Grid files. The VMF grid files can be found on XYZ2 at /Users/geodyn/SUPPORT/VMF\_GRID\_FILES. These files are 3 months long with a 2 week overlap at the beginning and end. vmfg\_20100401\_20100630 actually begins 20100315 and ends 20100715. This is to ensure overlap for longer arcs. To use the VMF Grid file the user should select the appropriate (one) grid file from the database and rename it "VMF\_GRID\_FILE" for use in IIS. IIS will then output a smaller file, "vmf\_interface\_file", that IIE will use for its processing.

Please note that IIS now has a module that must be compiled before the rest of the code. This module is called vmf\_module.f. Also, there is a second IIE module called vmf\_module.f that must be compiled prior to the rest of the IIE code.</p>

2. Some time tags were corrected in the VLBI code.
3. Updated code for multiple CGMASS option cards.
4. A telemetry file that contains non-conservative forces can now be created for the low earth orbiter (LEO) in a GPS run. See TELEM card for more information. We also have a utility program that can be used to read and dump this new TELEM file. The utility can be found on XYZ2 at /Users/geodyn/SUPPORT/UTILITY\_PROGRAMS/GPS\_TELEM. If you do not have access to XYZ2 please contact one of the Geodyn members for help.
5. Look also for new volume 5 documentation: TELEM file format for the LEO in a GPS run.

## 0.1.16 1201

NEW GEODYN VERSION 1201

GEODYN VERSION 1201 FEATURING

Introducing the following new/updated options in GEODYN:

1. External thermal file capability. This gives the user the ability to supply GEODYN with temperatures and emissivities to be used to compute the thermal emission acceleration on a variable number of satellites with variable number of panels. Please see the SATPAR card and the volume 5 THERMAL ACCELERATION FORMAT documentation.
2. A new option to use the SIGMA value in a GEODYN set up as a scalar instead of replacing the input data file value.
3. An internal Grail attitude model to accommodate telemetry gaps for real data. Leading and trailing satellites are specified in columns 10-11 on the SATPAR card
4. The ORBFIL option can now accommodate greater than 5 output units.
5. A memory fix for pole rates and some corrections to resolved problems.

## 0.1.17 0003

NEW GEODYN VERSION 1107

GEODYN VERSION 1107 FEATURING :.

Introducing the following new/updated options in GEODYN:

1. A new orientation model for planet Mercury, which includes longitudinal librations. (Jean-Luc Margot, 2010 ). The GEODYN documentation has been updated to include an index on the PLANET option card
2. GEODYN features a new printout option. The user may select the output S/C coordinates to refer to the center of figure instead of the center of mass. The ORBFIL option card has been updated to reflect this option
3. We have changed completely the way True Pole Coordinates are computed in GEODYN. The processing of the data is done observation by observation instead of processing the entire block. The reason for this change is that some of the corrections were done by interpolating between the first and the last observation. That has caused mismatches in Interplanetary Simulations.
4. We have updated the capability of processing direct altimetry for Interplanetary data. GEODYN users know that the state partials for direct altimetry, are computed in GEODYN numerically. The S/C coordinate perturbation during this computation may vary upon the case (Interplanetary/Earth). GEODYN now allows the user to define the amount of perturbation . Find more information on the new option card ALTIM2

Altimetry including Crossovers is a Measurement Type requiring a large amount of options. ALTIM2 will be available for more options in the future.

Within direct altimetry for Interplanetary cases, we also include planetary orientation adjustment capability. Right Ascension, Declination and Prime Meridian rotation partials are computed numerically both for measurement model and for the force model explicit partials. GEODYN allows the user to specify the numerical partial evaluation parameters. We have introduced the new option PLNOR2.

5. GEODYN 1107 has been updated to compute a relativistic correction for lunar ranges. Also GEODYN 1107 computes lunar range rates using polynomial differencing like all the other planets.
6. Code errors and reported GEODYN minor problems were fixed. These include Partial file problems, PUNCH problems, some inadequate allocations, etc.

## 0.1.18 0003

NEW GEODYN VERSION 1101

GEODYN VERSION 1101 FEATURING .

Introducing six (6) new/updated options in GEODYN:

1. UCL for Jason is available for more than one satellites now (5). This has been updated due to the need to apply the model for Jason I and Jason II in the same run. The UCL indices are specified on the SOLRAD option card.
2. The TOPATT option may now be used for more than one (TOPEX) satellites. The program recognizes TOPATT cards with unique satellite ids and allocates space accordingly.
3. The Empirical (Vienna) models, GMF (Global Mapping Functions) and GPT (Global Pressure and Temperature), were added as options to GEODYN. Please see the REFRAC option card for user specifications.
4. An old option card ANTPHC has been reactivated for the PCV corrections of the ground stations and together with the INSTRMNT card can only be manually implemented by the user.
5. The CRYOSAT-2 attitude model has been added as an option to GEODYN. To implement this model use option 15 under Spacecraft attitude control algorithm on the SATPAR card.
6. The multi-OFFSET adjustment modifications were added to the code to allow more than one OFFSET (leo) adjusted in one run.
7. Some code errors were fixed.

## 0.1.19 1007

NEW GEODYN VERSION 1007

GEODYN VERSION 1007 FEATURING...

GEODYN has been updated to allow users to specify if they want to update the normal matrix according to constraints in the last inner iteration before writing the EMATRIX file. In previous GEODYN versions the constraints were used in the last inner iteration only in data reduction runs.

New option placed in column 9 of CONDRG option

New option placed in column 9 of CON9PA option

**0.1.20 1006**

NEW GEODYN VERSION 1006

GEODYN VERSION 1006 FEATURING...

TDF has been updated to read Merit Extended Format.

## 0.1.21 1002

NEW GEODYN VERSION 1002

GEODYN VERSION 1002 FEATURING...

New time format in the external self shadowing file, see SLFSHD card  
Reading binary self shadowing file from IIS, see the SLFSHD card  
Reading time-dependent external CGMASS coordinates see the CGMASS card  
Some code corrections and modifications of LRO processing on the Mac(ifort)  
machines

**0.1.22 0908**

NEW GEODYN VERSION 0908

GEODYN VERSION 0908 FEATURING...

Multiple use of REFRAC options, by measurement type  
A correction in the PUNCH option regarding MBIASes  
Complete code for Self Shadowing SLFSHD  
Third link antenna force model support and some corrections pertaining to  
quaternia files.

### 0.1.23 0904

NEW GEODYN VERSION 0904

GEODYN VERSION 0904 FEATURING...

Capability of reading multiple external quaternions sets for different links of a single antenna. There is a modified OFFSET option card associated with this capability. Please look at the Volume 5 documentation changes [HERE](#) and [HERE](#) for the external attitude file.

An important correction to the Jason UCL model.

Some code corrections that will allow smooth compilation across the different platforms we are dealing with.

Increasing the hard coded satellite related arrays to 200.

The mupunchlti beam altimetry crossover capability in a dynamic mode.

The option related to this capability is STEP

A correction for the PUNCH file when using the UCL model.

Corrections to the REFRAC option to reflect the documentation.

## 0.1.24 0810

NEW GEODYN VERSION 0810

GEODYN VERSION 1810 FEATURING...

Introducing in GEODYN the option of Rapid Integration based on the following concept: One or more satellites will be integrated from the beginning to the end of the arc, and all the integration information (sums and partials) will be saved and will be used in a subsequent step of the run to reconstruct the orbits. Any number of satellites may be chosen for rapid integration and according to the dimensions of an internal buffer which will be used during the run to save information. When the internal buffer is filled up, the information is dumped on files. These files will be read after GEODYN has completed the fast integration for all the satellites in request and will proceed in reconstructing orbits and processing data. This capability is saving considerable time and space during altimetry crossover processing as it does not need to save information when one of the altimetric observations is encountered and wait for the pairing observation to show up in future time.

GEODYN 0810 features two more empirical Radiation Pressure models. UCL for the GFO spacecraft and UCL for ENVISAT. These models have been developed at the University College, London. These models are applied only when GEODYN does orbit determination or processes data from these S/C upon request of the user on the SOLRAD option card. The model uses three grid files that can be used to compute the S/C acceleration. These files must be present in the directory where GEODYN IIE is executed. They may be downloaded from the site: [http://terra.sgt-inc.com/pub/geodyn/UCL\\_FILES/](http://terra.sgt-inc.com/pub/geodyn/UCL_FILES/) . Updated OFFSET and SATPAR options show how to introduce an internal attitude model for ENVISAT.

## 0.1.25 0712

NEW GEODYN VERSION 0712

GEODYN VERSION 0712 FEATURING...

The relativistic clock correction for one-way range (measurement typr 39) in Solar-System Barycentric Frame has been added to this new version of GEODYN codes. The one-way range measurement will be used for LRO.

We have added the effect of ocean pole tide (see IERS 2003 chapter 6) using Desai's self-consistent equilibrium model to the geopotential. The application of this model is described in the documentation for POLDYN card.

**0.1.26 0711**

NEW TDF VERSION 0711

NEW FEATURES IN TDF 0711:

TDF

TDF has been made MAC compatible. The code may be downloaded from the site:

## 0.1.27 0707

NEW GEODYN VERSION 0707

GEODYN VERSION 0707 FEATURING...

GEODYN 0705 features the UCL JASON Radiation Pressure and thermal re-radiation models. These models are empirical and they have been developed at the University College, London. These models are applied only when GEODYN does orbit determination or processes JASON data upon request of the user on the SOLRAD option card. The Radiation pressure is separated in to the bus and solar panel models. The bus model uses three grid files that can be used to compute the S/C acceleration. These files must be present in the directory where GEODYN IIE is executed.

We have updated GEODYN to use upon user's request the IAU2000 constants for Venus. The Mercury IAU2000 constants have replaced the earlier values. See option PLANET column 23.

**0.1.28 0705**

NEW GEODYN VERSION 0705

GEODYN VERSION 0705 FEATURING...

GEODYN 0705 features modifications to make Measurement Type 85 (TDRSS) work for Interplanetary runs.

## 0.1.29 0511

NEW GEODYN VERSION 0511

GEODYN VERSION 0511 FEATURING...

- a. We introduce a new VLBI algorithm in GEODYN.  
Geodyn computes VLBI time delay in the far zone ( farther than 0.1 ps )  
using a modern package of routines VTD ( L. Petrov, 2006, in preparation ).

With the VLBI data processing, we have introduced several new parameters in GEODYN:

1. All the new VLBI related parameters are introduced as biases and they are described in the updated MBIAS option card. The new biases are:  
MBIAS 304 station clock bias in a spline form.  
MBIAS 501 tropospheric bias (zenith) in a spline form  
MBIAS 502 tropospheric bias gradient (east) in a spline form  
MBIAS 503 tropospheric bias gradient (north) in a spline form  
MBIAS 800 and 801 VLBI baseline clock bias.  
Please consult the updates MBIAS and MBIASN options for details.
  2. There is a new option CONSPL which introduces constraints to spline type biases.
  3. There is a new option NETCON which introduces constraints to station network rotation and translation, and to quasar network rotation.
  4. Finally there is a new group of arc VLBI options which is useful to a special GEODYN version directly linking to the VTD routines and libraries. (\*) With these options OPVLBI, VLBSTR, and ENDOPV the user may specify input files and other information through alphanumeric strings  
  
(\*) This "special VTD version" is not using GEODYN to compute station related quantities, nor it is using GEODYN input tables for EOP computations. It is using only some GEODYN setup features and it reads several external files. For the time being this version is not available in this 0511 GEODYN.
- b. There are also some corrections related to the mpi GEODYN version

### 0.1.30 0502

NEW GEODYN VERSION 0502

GEODYN VERSION 0502 FEATURING...

1. The entire GEODYN code has been modified to FORTRAN free format.  
This is a SPECIAL NOTE to GEODYN users who add modifications to our code.  
Please follow the FORTRAN free format code rules and please avoid using TABS.
2. We introduce the YARKOVSKY/SCHACH model for the LAGEOS satellites.  
The Yarkovsky/Schach model has two different versions, one for fast rotating Satellites and one for slowly rotating Satellites. They are both available in GEODYN.  
Because shadowing information is needed ahead for the computation of the perturbing acceleration, two GEODYN runs are needed for the model to apply: One to create the shadowing information and one to compute the effect.  
A new global option is available to describe the use of the new global capability: YARKOV  
The Yarkovsky acceleration may be applied in a high rate integration scheme. Look how in the updated HRATEF.

### 0.1.31 0407

NEW GEODYN VERSION 0407

GEODYN VERSION 0407 FEATURING...

1. A new option has been added to GEODYN that allows the application of atmospheric loading pressure at all sites featured in a GEODYN setup. This capability is invoked with the new global option APLoad (see volume 3 on the web site) and it requires the presence of a new IIS input file on unit 24 with atmospheric pressure loading displacements information.

To facilitate the application of atmospheric pressure loading, we have created a preprocessor which produces the input unit 24 from information downloaded from the official site:

<http://gemini.gsfc.nasa.gov/aplo/aplo.shtml>

To create the APLFIL file (to be read in from unit24 as GEODYN INPUT).

```
=====
INPUT DATA:  Atmospheric Pressure Loading information downloaded
from the site http://gemini.gsfc.nasa.gov/aplo/aplo.shtml
```

```
execute the utility
/users/geodyn/APLFIL/mk_APLFIL
```

It expects fort.4 with the following info.

- 1 & 2 EPOCH start & stop time of the geodyn run  
the APLFILE will be for the time span 3 hours before the start time  
and 3 hours after the stop time read in.
- 3 name of the file with latitude and longitude for all the sites  
(read in on unit\_10)
- 4 name of the file with information to map the 5\_digit "DN" number  
to geodyn\_station\_number (read in on unit\_1)
- 5 name of the file to which the output APL file is to be written  
(written to unit\_24)
- 6 name of the directory which has all the downloaded  
files in the BINDISP format.
- 6+.. the list of stations (5\_digit site number) (one per line)  
data for each site is read from unit\_10 and processed

```
## FORT.4
## =====
0403201800          #start time of data - GEODYN EPOCH
0403280600          #stop  time of data (yyymmddhhmss)
/users/geodyn/APLFIL/stn_lat_lon      #lat_lon_info for all sites
/users/geodyn/APLFIL/stn_mapping_info  #info for mapping DN# to geodyn_stnno
/users/geodyn/APLFIL/OUTPUT_APLFILE   #file to which output should be written
/users/geodyn/APLFIL/INDATA           #name of DIRECTORY which has the INPUT files
12341          # list of the stations (5_digit DN#) one per line
40451
##
```

FORMAT OF THE OUTPUT APL FILE - unit\_24

=====

(this binary file has all integer words)

General Header record: header designator=1, Number of sites,

number of geodyn stations at each site,  
begin\_time(mjds), endtime(mjds) &  
time interval(secs) for displacement data

Record-2 : index=2, total number of geodyn stations  
list of ALL geodyn stations in the file

### for each site, site header is followed by "NREC" data records

Site Header record : index=3, Number of stations at this site,  
list of stations at this site,  
number of records "NREC"

Data records : index=4, East, North, Vertical components of  
atmospheric pressure loading displacement.  
(units 1.D-9 meters)

2. We introduce the option to use "Doodson" Tide models as alternatives to the presently existing "Colombo" models. The new models will be used if the new global option RAYTID is present. (See Volume 3 on the web site). New models exist for the standard tides (TIDE), for earth tides (ETIDES) and ocean tides (OTIDES). The input format of the respective option cards has changed for the new models. Users who wish to keep using the old "Colombo" formulation do not need to change anything in their setups.
3. The new GEODYN version features the extended IERS formulation for solid earth tide coefficients K2LOVE and L2LOVE. If your setups include these cards the results might be slightly different compared to older versions.

## 0.1.32 0302

NEW GEODYN VERSION 0302

GEODYN VERSION 0302 FEATURING...

- 1) New State vector parameterization scheme that uses the combination of the state vectors of two satellites, in the form of 12 parameter baseline, and mid-point representation. The full description of this parameterization which is useful for intersatellite measurements, may be found in the following reference:  
"Short-arc analysis of intersatellite tracking data in a gravity mapping mission", D.D.Rowlands, R.D.Ray, D.S.Chinn, F.G.Lemoine, Journal of Geodesy (2002)76:307-316
- 2) Modifications to the local gravity option, including new documentation for input information (Look at the updated LOCALG option card)
- 3) Modifications to the PUNCH option to output correctly the updated values for Master-Constrained stations in constrained adjustments cases.
- 4) Updates for GPS block IIR satellites attitude
- 5) New capability: For efficient timing purposes, GPS EMAT runs will stop right after the E-MATRIX has been formed and saved. There will be no arc adjustment after this. This is the new default scenario starting in version 0302. Of course if the analyst desires to perform the final arc adjustment, this is possible by requesting so with an index greater than zero on the 7th column of the GPSMOD input option card.

### 0.1.33 0211

NEW GEODYN VERSION 0211

GEODYN VERSION 0211 FEATURING...

- 1) New Options related to Mars Global Surveyor analysis:
  - a. A new atmospheric density model: Stewart (revised by Lemoine) Invoked on the ATMDEN option card.
  - b. New 2000 IAU Mars constatns. Invoked on the PLANET option card (for Mars) Default constants for Mars are 1991 IAU.
  - c. Code to compute and apply Mars Moons tidal effects on the S/C
- 2) New Option: User input crossover editing criteria (Updated ALTIM option card)
- 3) New : Code to handle large ambiguity residuals for Interplanetary runs
- 4) New : Code introduced for the new Compaq Halem. A new Geodyn Post Processor version allows GEODYN to OPEN the Interface and Data files with CONVERT=BIG\_ENDIAN and calls to a new subroutine BYTE\_SWAP allows the correct conversion of CHARACTER arrays.
- 5) Corrections to: the DSTATE option, Computation of POLE rates, GPS, external ephemeris, ephemeris correction, time dependent gravity, and force model partial pointers.

NOTE: At the same time with GEODYN 0211 a new point version of TDF has been released: tdf0006.04. It features modifications that allow more precision in the MET WORD for laser data passed in to GEODYN when the MERIT II format is used as input.

### 0.1.34 0209

NEW GEODYN VERSION 0209

GEODYN VERSION 0209 FEATURING...

1. New Capability: Solving for delta state vector at a given time T  
This new capability allows the user to solve for and update the state vector at a user provided time T. This capability is useful when at that time T we encounter acceleration thrusts.  
The new option DSTATE is an arc option and it is described on the geodyn Web Site.
2. New Capability: Satellite Antenna Cutoff capability.  
The new option ANTCUT allows the user to perform GPS satellite antenna cutoff editing. The user must provide the normal to the antenna plate unit vector and a cutoff angle. (See the arc option ANTCUT on the geodun Web Site
3. New capability: For all GPS satellite antennae, geodyn computes and applies a phase windup correction. The orientation may be provided on the modified OFFSET arc option.  
(See OFFSET on the geodyn web site)
4. New capability: For phase data provided on IIS input unit 22, geodyn computes and applies a phase correction for GPS satellite antennae.  
(See ANTPHC arc option)
5. New capability: User specified number of parallel processors to be used in an EMAT run.  
(See updated EMATRX option card on the geodyn Web Site)

## 0.1.35 0205

NEW GEODYN VERSION 0205

GEODYN VERSION 0205 FEATURING...

### 1. New Capability: Acceleration Thrust handling in GEODYN

When thrusts occur during an arc, GEODYN can handle them by using the ACCEL9 capability. However for very small duration thrusts, a larger step size would not pick up the thrust effect unless the thrust occurred right at the step of the integration. For this reason GEODYN has been modified to handle very short thrusts.

The Option ACCEL9 is associated with this capability and it was modified on the Web Documentation.

### 2. New Capability: Tropospheric Bias Constraints

A new option similar to the old reduced dynamic option of force model parameters (CON9PA, CONDRG, CONSOL), only this is a station dependent option. There is a new Option CONBIA associated with this capability in the Web Documentation.

### 3. This version also includes some important modifications related to multi-satellite accelerometer data processing and multi-rate integration.

### 0.1.36 0202

NEW GEODYN VERSION 0202

GEODYN VERSION 0202 FEATURING...

1. New Capability: Multi-Rate Integration

New options associated with this capability:

- a. STEP. Modified option to allow small stepsize specification.
- b. HRATEF. New option to allow specifications for high rate integration.

NOTE: This capability is available to all GEODYN users.

THE NEW CAPABILITIES BELOW ARE NOT AVAILABLE TO THE GENERAL PUBLIC:

2. Accelerometer Data Processing used in Geometric Mode: This is the option where the accelerometer data are used as measurements and they do not drive the S/C.

New options associated with this capability: ACCLRM, ACCBIA, SURFRC, AXES, ENDACC

3. Accelerometer Data Processing used in Dynamic Mode: This is the option where the accelerometer data are used to drive the S/C.

New options associated with this capability: ACCLRM, ACCBIA, SURFRC, AXES, DYNSEL, ENDACC and the modified ATITUD option.

There is more documentation related to the above options: Check Volume 5 for the description of new measurement types and the description of the new External Acceleration File.

### 0.1.37 0104

NEW GEODYN VERSION 0104

GEODYN VERSION 0104 FEATURING...

The following new or modified options are introduced in the new GEODYN version 0104:

Features:

Application and Estimation of Earth Orientation Parameters Rates (X pole rate, Y pole rate and A1-UT1 rate). There are some modifications on the POLEUT option cards in Volume 3, and a description of the model in the last Note of the POLEUT cards. Also look for a new Emat Label for the Pole Rates immediately after the Pole Values Emat Label on Volume 5.

The introduction of the Mendez (Porto) refraction model for Laser data Look for a new index on the REFRAC option card.

## 0.1.38 0101

NEW GEODYN VERSION 0101

GEODYN VERSION 0101 FEATURING...

The following new or modified options are introduced in the new GEODYN version 0101:

Features:

NEW: The new LINK option: This option allows the user to link any two parameters in a constrained solution in GEODYN, by using unit 5 specifications (NEW LINK GLOBAL OPTION CARD). First to facilitate the identification of the parameters GEODYN IIS was modified to print out the internal estimated parameter number next to the parameter name in the IIS summary section. After identifying the parameters to be linked, the user can make a request using the LINK card. GEODYN IIE uses this information to first fold the second parameter row and column into the first and then reduce the normal matrix by so many rows and columns as the LINK options. Both LINKED parameters show in the IIE update summary featuring the same correction. This option works for arc parameters only for the time being.

New EMAT label numbering scheme. Due to the increasing number of ARC parameters in GEODYN, it was necessary to modify the numbering scheme by moving the global parameter labels up. Section 4 of volume 5 was modified to reflect these changes.

NEW GEODYN VERSION 0101

GEODYN VERSION 0101 FEATURING...

The following new or modified options are introduced in the new GEODYN version 0101:

Features:

NEW: The new LINK option: This option allows the user to link any two parameters in a constrained solution in GEODYN, by using unit 5 specifications (NEW LINK GLOBAL OPTION CARD). First to facilitate the identification of the parameters GEODYN IIS was modified to print out the internal estimated parameter number next to the parameter name in the IIS summary section. After identifying the parameters to be linked, the user can make a request using the LINK card. GEODYN IIE uses this information to first fold the second parameter row and column into the first and then reduce the normal matrix by so many rows and columns as the LINK options. Both LINKED parameters show in the IIE update summary featuring the same correction. This option works for arc parameters only for the time being.

New EMAT label numbering scheme. Due to the increasing number of ARC parameters in GEODYN, it was necessary to modify the numbering scheme by moving the global parameter labels up. Section 4 of volume 5 was modified to reflect these changes.

### 0.1.39 0006

NEW GEODYN VERSION 0006

GEODYN VERSION 0006 FEATURING...

The following new or modified options are introduced in the new GEODYN version 0006:

Features:

NEW: A new option that allows the use of multiple input grid files. This option is useful for combining ocean and land elevation data in the same run.

NEW: The capability of solving for the state vector of any celestial body featured in the Supplementary Planetary Ephemeris. This is an extension to the old PLNEPH option.

Revised and updated code for Laser Altimetry modeling.

Corrections to various code problems.

TDF

The capability of forming logical blocks separately for land and ocean observation

#### 0.1.40 0003

NEW GEODYN VERSION 0003

GEODYN VERSION 0003 FEATURING...

The following new or modified options are introduced in the new GEODYN version 0003:

Features:

NEW: A Radial Separator parameter for Dynamic Crossover processing.

NEW: Introducing an Attitude Timing Bias for Altimetry.

NEW: Introducing an altimetric Timing Bias.

Updated: The GFO attitude model for Geodetic pointing.

NEW: Application of ionospheric correction to the altimetry measurements used for Dynamic Crossovers.

Updated: GFO attitude model for geodetic pointing.

Updated: Laser Altimetry Modeling, more efficient grid model storage and computations, more efficient observation model iterative procedures.

NEW: Introducing the Ray GOT99.2 grid Ocean Tide model in GEODYN.

Updated: The GEODYN Internal Reference Time option will no longer affect GEODYN output files. It may be used for internal GEODYN computations and it is required for dates beyond 2008. The new version of TDF0003 reflects these modifications. Substantial corrections to the Supplementary Planetary Ephemeris, derived from simulations and initial EROS data processing.

Corrections to various code problems.

#### 0.1.41 9912

NEW GEODYN VERSION 9912

GEODYN VERSION 9912 FEATURING...

##### Features:

NEW:Supplementary Planetary Ephemeris. This new option allows GEODYN to consider celestial bodies not included in the JPL planetary ephemeris. The extra celestial bodies might be used as center of integration or just for force model computations. The user may also substitute the Chebyshev coefficients of a celestial body featured in the JPL planetary ephemeris with a new set of coefficients. See new global option EPHEM2 and SCBODY in Vol. 3

The option of using Proudman Function for sea surface evaluation has been modified to allow time dependent functions with up to three periodic terms, and estimation of all the coefficients of these terms. See updated SSTMOD global option.

Modifications to allow flexibility in the output reference system of the satellite ephemeris. See updated arc options ORBTUV and ORBFIL.

Corrections to various errors.

## 0.1.42 9903

NEW GEODYN VERSION 9903

GEODYN VERSION 9903 FEATURING...

### Features:

GDYNEP - New option to allow the user to modify the internal GEODYN default reference time. This capability was designed to allow data processing beyond the year 2008, where the use of the default internal reference time causes an integer overflow.

Two-way laser altimeter data modeling improvements.

GEOLOCATION FILE - Expanded to include observation corrections and attitude information.

PDOUT FILE - New output option which is used to recreate a G1B extended altimetry file. This option is invoked using the ALTOUT option.

Attitude modeling for VCL. See OFFSET and SATPAR option.

Memory optimization for dynamic crossover processing capability.

### 0.1.43 9812

NEW GEODYN VERSION 9812

GEODYN VERSION 9812 FEATURING...

Features:

Full GPS data processing capability

Adjustment capability for the tracking offset coordinates on a satellite

Revised two way Laser altimeter modeling

Three new attitude models: EUVE, GFO, and TRMM

Option to modify and solve for parameters related to the relativistic Lense

Thirring effect.

Code modifications for the f90 compiler

Code modifications for SUN operations

Optimized code for the Dynamic Crossover modeling

Corrections to various problems.